SWALES AEROSPACE

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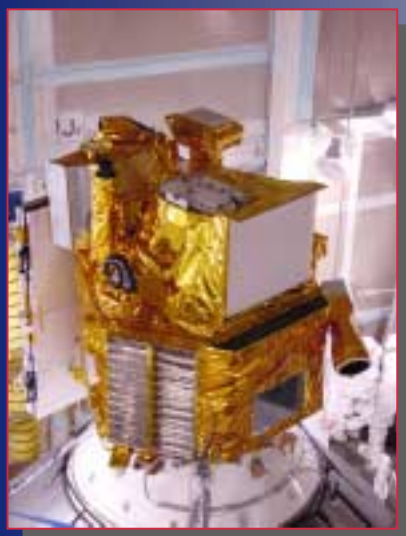
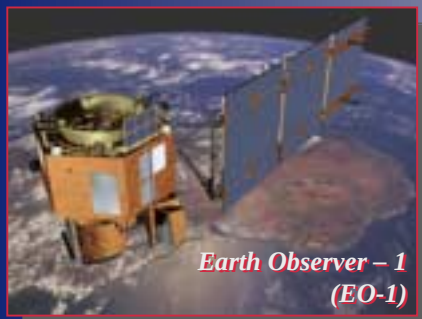
Earth Observer ~ Spacecraft Bus





Earth Observer – 1 (EO-1)

Mission Overview

The Swales Aerospace Earth Observer - Spacecraft Bus (EO-SB) is based on the extremely successful EO-1 Spacecraft Bus launched in November 2000. The EO-SB can accommodate multiple instruments with a total payload mass capability of up to 236 Kg depending on the option selection. The EO-SB baseline launch vehicle is the Delta II 7320-10 in the DPAF configuration, however, the EO-SB is compatible with the Taurus and Athena launch vehicles. The EO-SB has been designed primarily for orbits ranging from 400 Km through 900 Km and it can be adapted to other mission orbits.

Mechanical Subsystem

The EO-SB core system structure is primarily an aluminum longeron stiffened panel design with top and bottom equipment/payload decks. The EO-SB can minimize the distortion induced into the instrument via a de-coupled flexible instrument interface resulting in low levels of transmitted strains to the payload and to the key GN&C components. The closed construction provides an equi-potential faraday cage for the Spacecraft components and is referenced to a single point ground plane.

Power Subsystem

The EO-SB Power subsystem is an unregulated (+28V +/-6Vdc), Direct Energy Transfer (DET) power system that supports one 50-A-hr Super Nickel Cadmium battery (baseline) connected directly to the power bus. The power subsystem controls the Spacecraft energy balance, switches and distributes the unregulated power and provides power fault protection. The power system utilizes a digital shunt regulator with Pulse Width Modulation for fine current control.

Guidance, Navigation and Control (GN&C)

The EO-SB GN&C subsystem is a 3-axis inertially stabilized system. The generalized control logic allows for the baseline zero-momentum system to have an offset wheel speed bias about a preferred (typically a scan profile) axis in order to provide additional gyroscopic stiffness to the system, resulting in additional pointing control performance about the two non-bias axes, if desired. The autonomous on-board safing logic initiates appropriate actions based on input from the distributed parameter sensing elements resulting in graceful mode transitions as successive safe-hold levels are achieved. The safe-hold mode resides on a separate processor from the main GN&C processor. Ground interaction restores normal operations from the safe states.

Reaction Control System Option

The EO-SB can accommodate a Reaction Control System, which is based on the EO-1 heritage configuration and can be used for precise orbit maintenance functions. The hardware and software interface elements exist in the core system to accommodate this option.

RF Communications

EO-SB uses S-Band for command and telemetry, and X-Band Phased Array Antenna for down linking science data at 105 Mbps (High Speed Data Chain Option). The S-Band system has two S-Band omni antennas and will use TDRSS at 2 kbps for early-orbit monitoring, but nominal operations for downlink are at 2 Mbps which is available for science data downlink. The S-Band system is compatible with the STDN, DSN and TDRSS.

Command and Data Handling

The C&DH and attitude control system (ACS) software reside in the Attitude Control and Data System (ACDS), which contains a 12 MHz Mongoose V processor with 1.8 Gbits of storage. The C&DH software functions include directing all traffic on the 1773 data bus; storing, executing, and routing commands; formatting and filtering telemetry; failure detection; and safing the spacecraft in an event of an anomaly. Most subsystems contain a Remote Services Node (RSN), which is a R000 processor for both 1773 interface and subsystem control. A 1553 data bus is also available. In the High Speed Data Chain option, a separate solid state recorder is available for more demanding science data storage missions.

Thermal Design

The EO-SB thermal design is a cold-biased passive architecture using thermostatically-controlled heaters to provide balance during the mission life. Passive Multi-Layer Insulation (MLI), coatings, thermistors, and heater/thermostats comprise the thermal control hardware complement. The thermal design maintains the core bus and component boundary temperatures between 0 to 40°C for nominal operational modes.

Earth Orbiter ~ Spacecraft Bus

Technical Specifications

Payload	Average Payload Power	256 W (EOL)
	Payload Mass Limit of Bus	236 kg
	Bus Dry mass (w/o Payload & options)	332 kg
	External Volume available for Payload	1m x 0.75m x 1.5m high
	Internal Volume Available for Payload	280mm x 232mm x 180mm high
L/V	Compatible LVs	Delta II 7320-10 DPAF, Taurus, Athena
	Payload Attach Fitting	3712
	Nominal Orbit	400<apogee<900 km
	Types of Orbits available	0<Inclination<99 deg; Accommodated with minor solar array cant-angle mod
Attitude Control	Pointing Knowledge	36/36/36 arcsec (3 sigma)
	Pointing Accuracy	60/60/60 arcsec (3 sigma)
	Pointing Stability (Jitter)	0.3 arcsec/sec
	Slewrate	15 - 60 deg/min
	ACS	Zero Momentum, 3 axis stabilized
	GPS	1 receiver
	Navigation Accuracy	45m Cross Track (3 sigma) 55m Along Track (3 sigma) 30m Altitude (3 sigma)
Comm / C&DH	Science Data Downlink capacity	Mission Specific (Core System = 2 Mbps)
	Science Data Storage capability	Mission Specific (Core System = 1.8 Gbits)
	C&DH Bus Architecture	Mongoose V, Rad Hard at 12 Mhz RISC Architecture
	Downlink Formats/Network	CCSDS / STDN, DSN, TDRSS
	Downlink Band	S-Band (variable to 2 Mbps) & optional X-Band (105 Mbps)
	Uplink Band	S-Band (2 Kbps)
Power	Batteries	Super NiCd / 50 Ah
	Arrays	3 Panel / Si w/GaAs / Articulating / 5.25m
	Nominal Voltage	28 V
	Structure	Hexagonal; aluminum honeycomb
	Propulsion Option	1 tank / 4 thrusters
	Propellant Capacity	22.3 kg
	Max delta V	>100 m/s
	Mission Design Life	1.5 years
	Heritage Mission(s)	EO-1
	Nominal Schedule - Ready for Launch	36 months
	Contract Options	High Speed Data Chain & X-Band System Propulsion System 1773 to 1553

SWALES AEROSPACE

"Our mission is to provide world class engineering and systems solutions that enable our customers to succeed in the global aerospace industry."

Tom Swales - Chairman
Swales Aerospace

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